



Western Wind and Solar Integration Study Update

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NREL
SWAT Meeting
Apr 30, 2008**

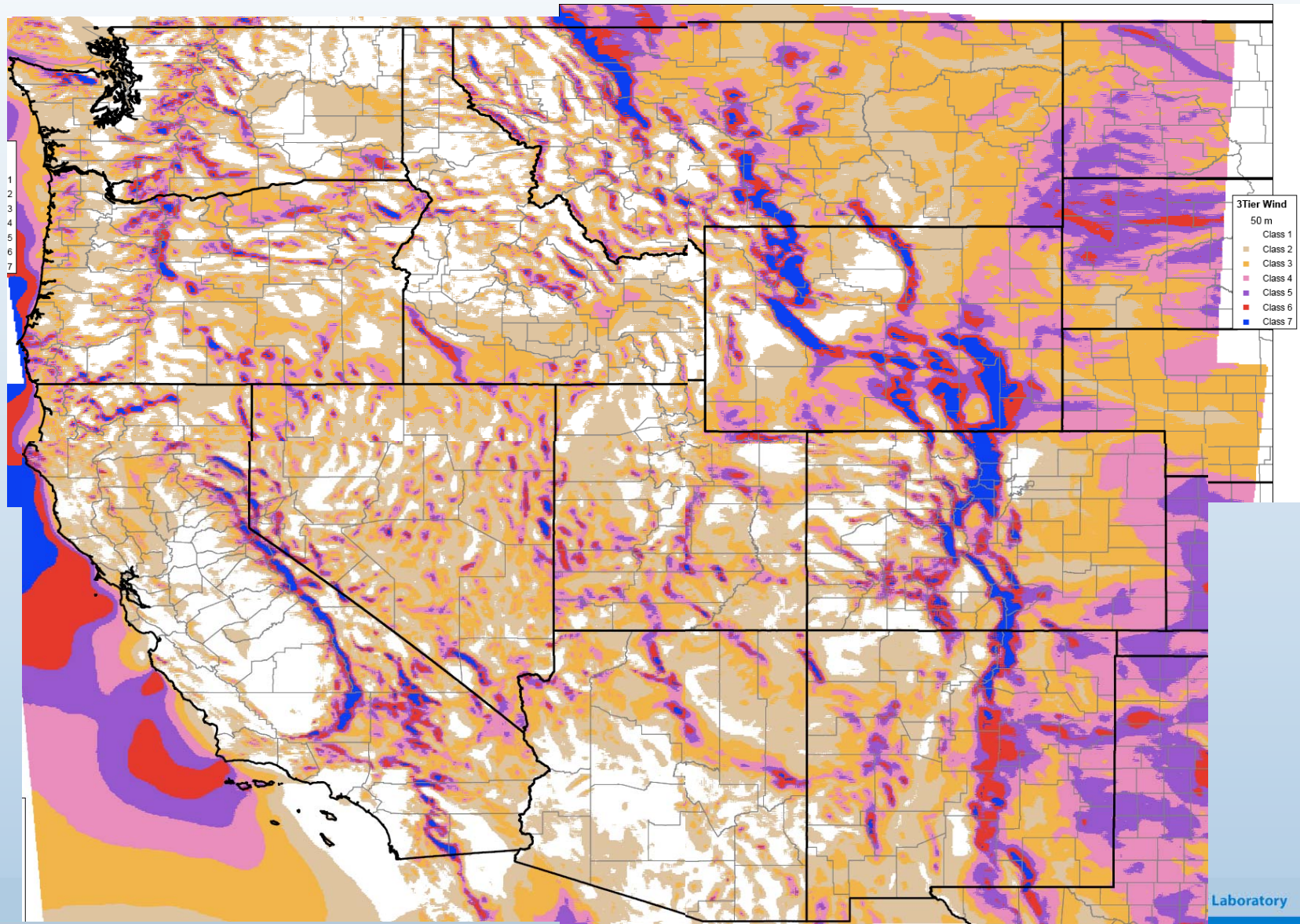
Tasks and Schedule

- Stakeholder Meeting (5/23/07)
- Data Collection (until 5/08)
 - Wind and solar mesoscale modeling (3TIER)
 - Utility load, generator, transmission data (Exeter)
- Preliminary Analysis (3-7/08) - GE
 - Extensive statistical analysis with various options for wind/solar sites and transmission
- Scenario Development (8/08) - GE
 - In-state vs out-of-state resources
 - Geographically diverse resources vs Mega projects
 - Best correlated with load
 - High solar
- Stakeholder Meeting at NREL in CO (8/14/08)
- Run Scenarios (starting 8/08) - GE
 - Simulate 2017 using load/climate patterns of 2004-6
 - Examine costs due to regulation, load following, unit commitment
- Preliminary Technical Results (end '08)
- Reporting and Stakeholder Meeting (mid '09)

High Renewables Basecase 2017

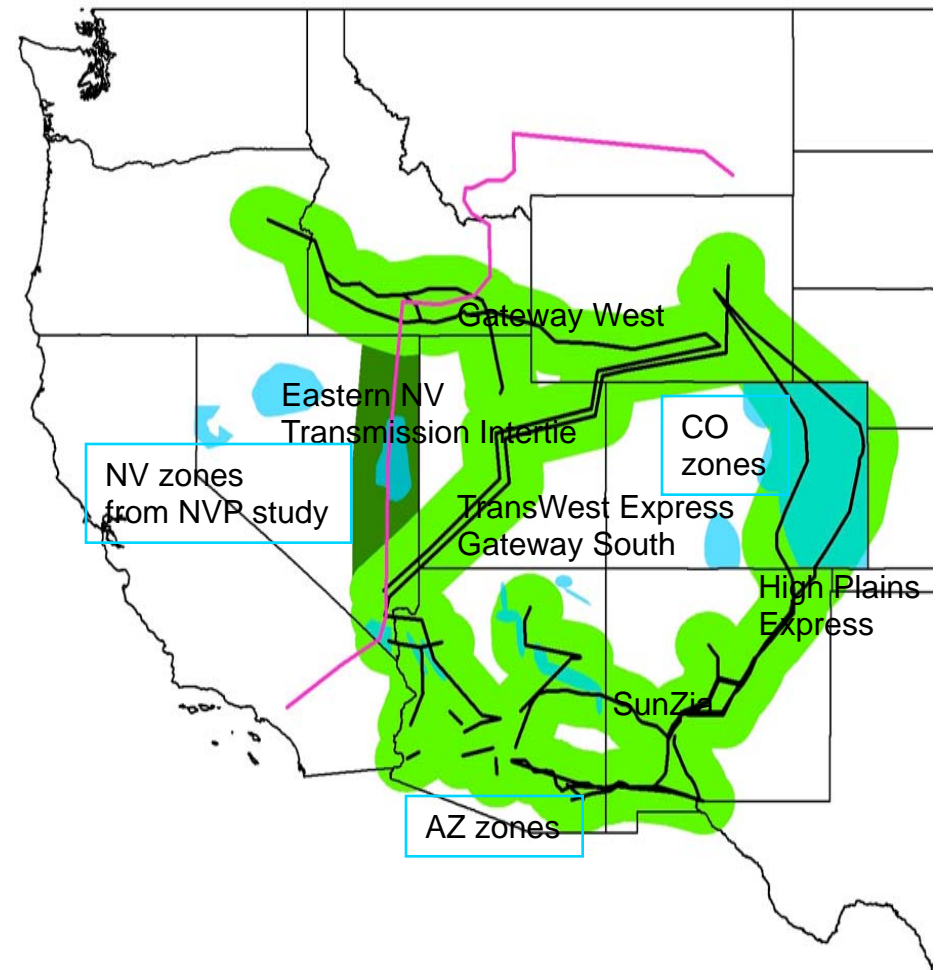
	Wind	Solar PV	Concentrating Solar Power	Total
Study footprint (WestConnect)	30% by energy	1.5%	3.5%	35%
	28,256 MW	2472 MW	2884 MW	33,613 MW
Rest of WECC	20%	0.9%	2.1%	23%
	36,767 MW	2895 MW	3378 MW	43,040 MW
Total	65,023 MW	5368 MW	6262 MW	76,654 MW

Average Wind Power Density 2006



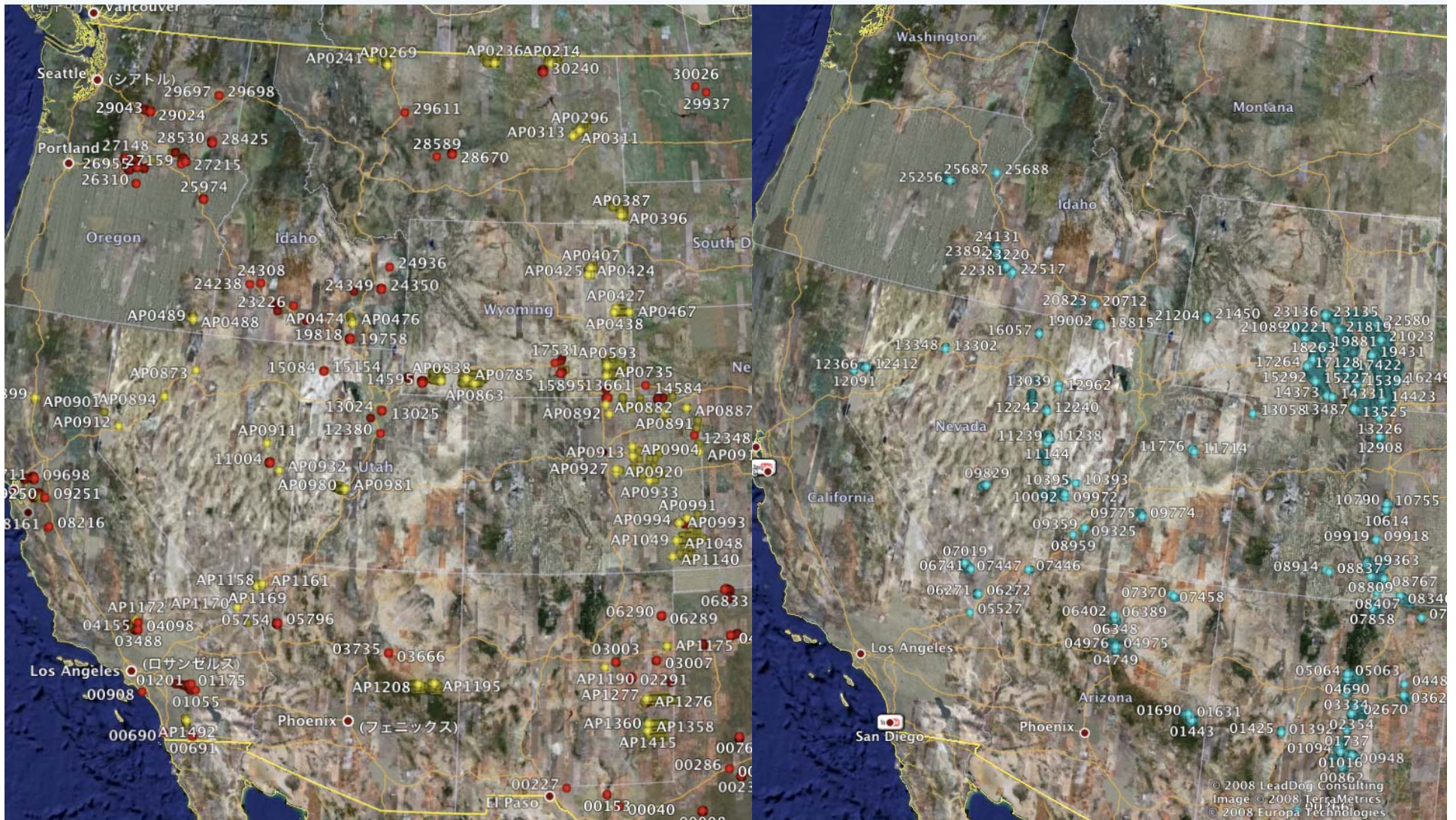
Site selection

- 3TIER downselected from 1.2M to 30,000 points. GE will select final sites.
 - Exclusions - recreation, urban, forests, slopes, high elevation, etc. (NREL)
 - Preselected sites - existing or planned wind plants (Platts database/NREL)
 - Transmission corridors or zones (200 GW) - based on proposed new transmission and initial zone information (excl new NV zones)
 - Load correlation (250 GW) - best diurnal correlation with Westconnect load
 - Best resource (450 GW) - best wind power density
 - Additional sites added in to help validate model results

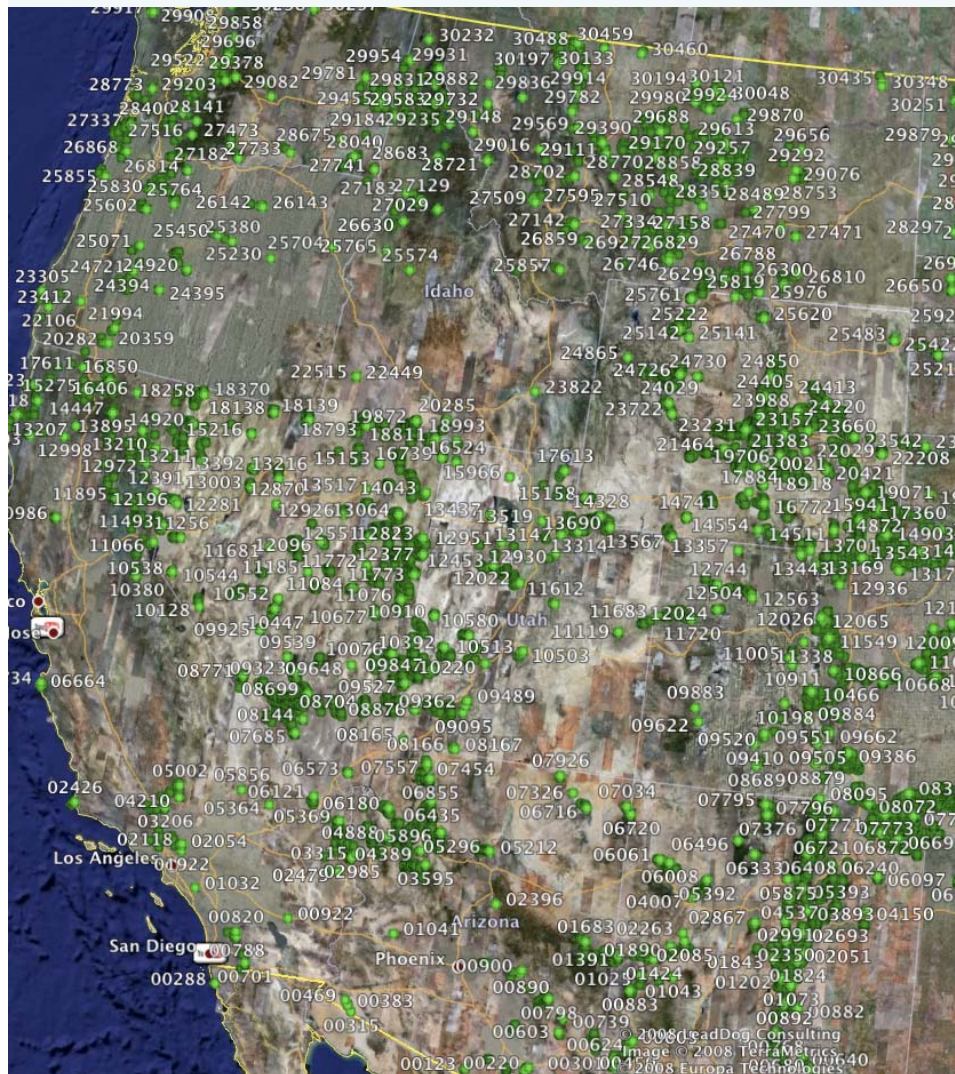


Preselected

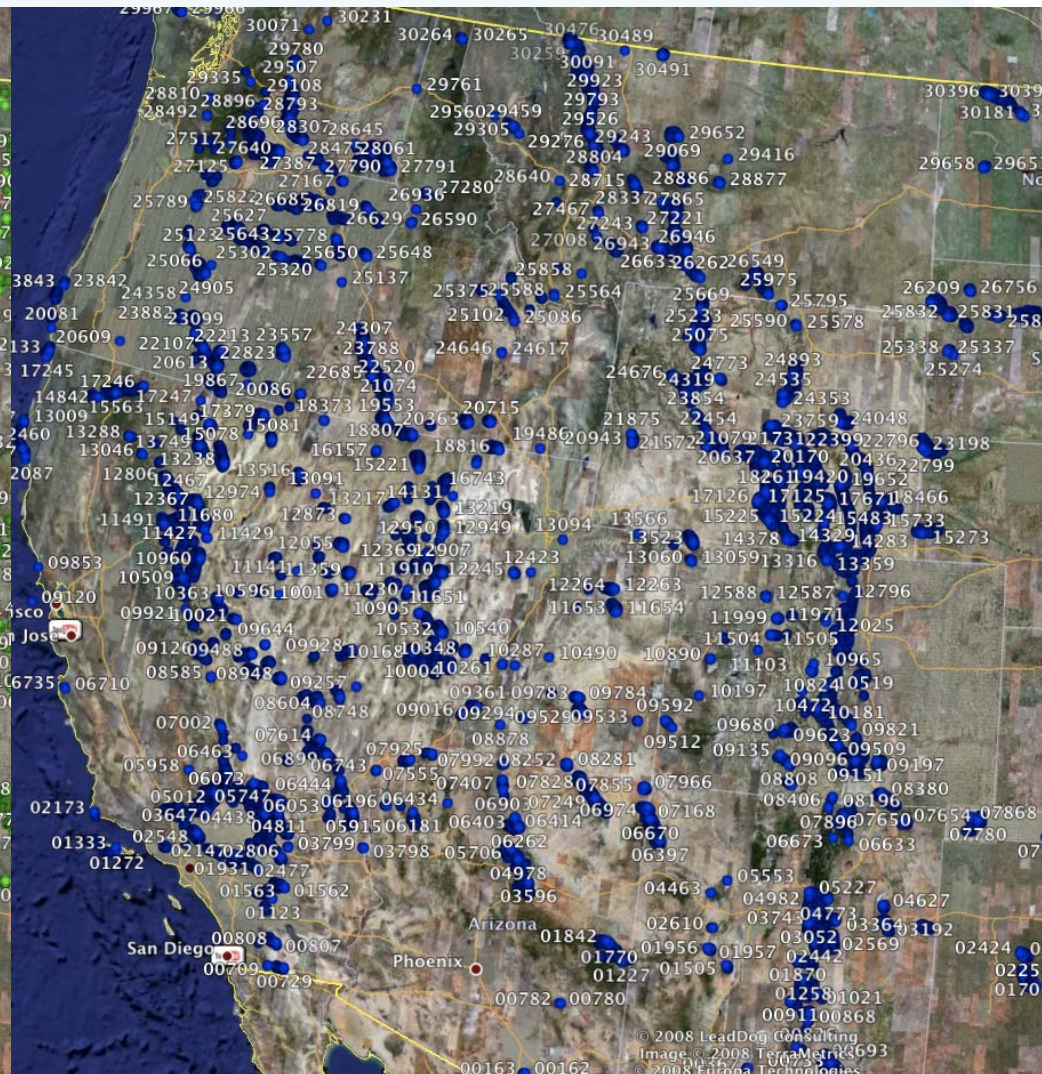
Transmission corridor/zone



Load correlated



Best resource

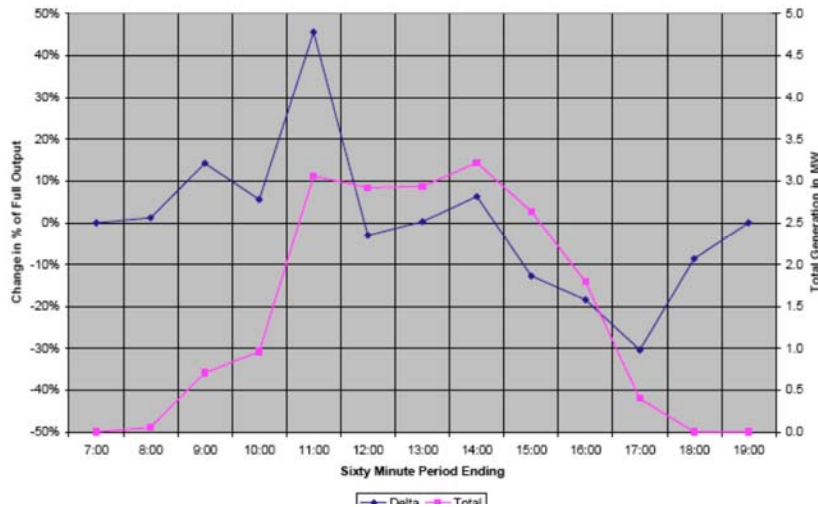


Solar Modeling

- Perez of SUNY ran solar model for US
 - 10km x 10 km grid
 - 1 hour intervals for 2004-2006
 - Direct normal and global insolation
 - Available at http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/
- PV Modeling
 - By weather station site (150 sites for western US)
 - Template of different orientations and tracking configurations
- Concentrating Solar Power (CSP) Modeling
 - Parabolic trough plants with 6 hours thermal molten salt storage, similar to APS Abengoa plant
 - Modeled over 200 GW of CSP sites

Need for Subhourly PV Analysis

SGSSS 12/3/2005 60 Minute Power Changes for the Full System



SGSSS 12/3/2006 1 Minute Power Changes for the Full System

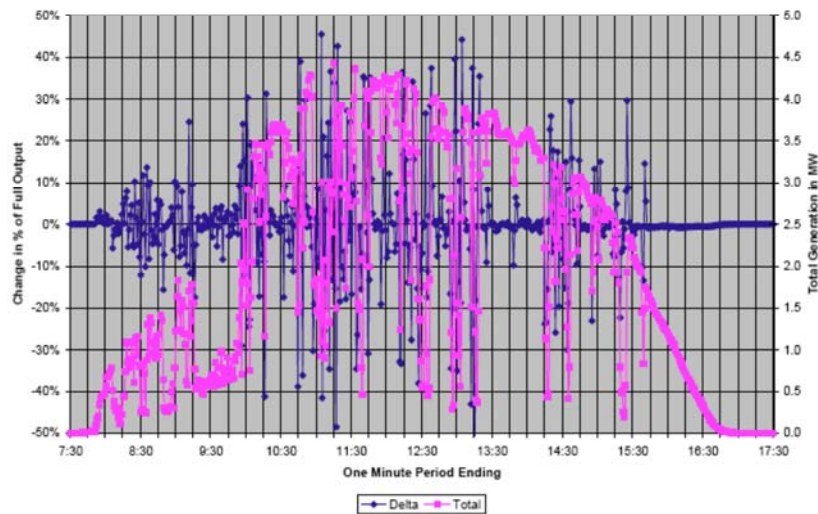
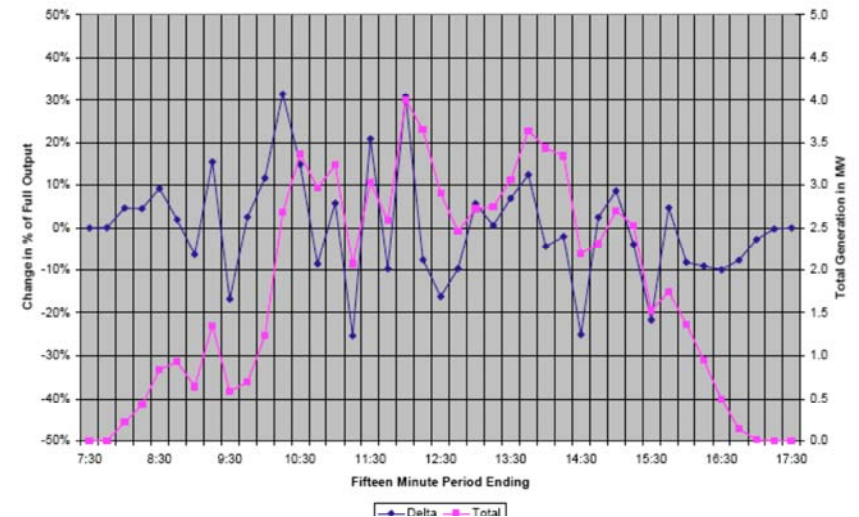


Figure 10

SGSSS 12/3/2005 15 Minute Power Changes for the Full System



SGSSS 12/3/2005 10 Second Power Changes for the Full System

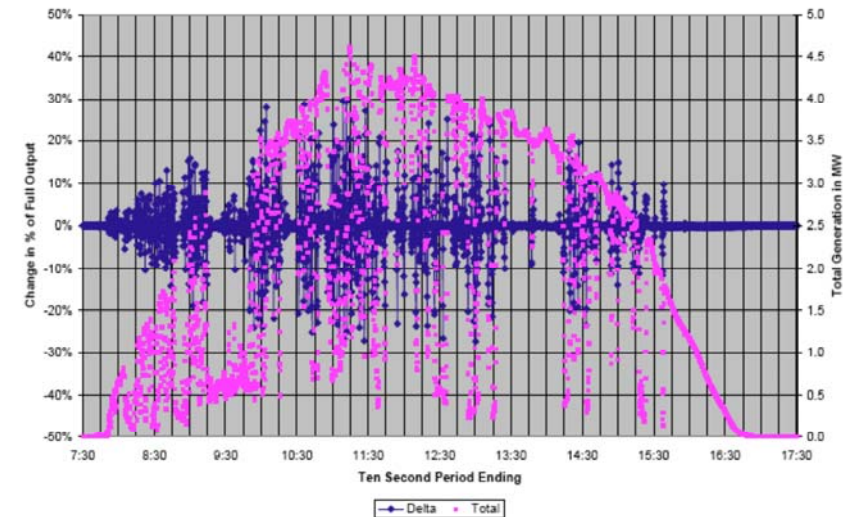


Figure 11

Source: Tom Hansen, Tucson Electric Power

Contact Information

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